

Amendments to the Claims

Please amend Claims 1, 11 and 21. The Claim Listing below will replace all prior versions of the claims in the application:

Claim Listing

1. (Currently Amended) A computer-implemented method for modeling a non-linear empirical process, said method comprising the steps of:
 - creating an initial model generally corresponding to the non-linear empirical process to be modeled, the initial model having a base non-linear function, an initial input and an initial output;
 - constructing a non-linear network model based on the initial model, the non-linear network model having (a) multiple inputs based on the initial input and (b) a global behavior for the non-linear network model as a whole that conforms generally to the initial output, the global behavior being at least in regions of sparse initial input; and
 - calibrating the non-linear network model based on empirical inputs by using a bound on a derivative of the base non-linear function to constrain parameters of the model to produce a constrained model with global behavior of the non-linear network model, the constrained model providing precision control of the non-linear empirical process.
2. (Original) The method of Claim 1, wherein the step of creating the initial model includes specifying a general shape of a gain trajectory for the non-linear empirical process.
3. (Original) The method of Claim 1, wherein the step of creating the initial model includes specifying a non-linear transfer function suitable for use in approximating the non-linear empirical process.
4. (Original) The method of Claim 3, wherein the non-linear network includes interconnected transformation elements and the step of constructing the non-linear

network includes incorporating the non-linear transfer function into at least one transformation element.

5. (Previously presented) The method of Claim 4, wherein the step of calibrating the non-linear model includes setting constraints by taking a bounded derivative of the non-linear transfer function.
6. (Original) The method of Claim 5, wherein the non-linear transfer function includes the log of a hyperbolic cosine function.
7. (Previously presented) The method of Claim 1, wherein the non-linear network model is based on a layered network architecture having a feedforward network of nodes with input/output relationships to each other, the feedforward network having transformation elements; each transformation element having a non-linear transfer function, a weighted input coefficient and a weighted output coefficient; and the step of calibrating the non-linear network model includes constraining the global behavior of the non-linear network model to a monotonic transformation based on the initial input by pairing the weighted input and output coefficients for each transformation element in a complementary manner to provide the monotonic transformation.
8. (Previously presented) The method of Claim 1, wherein the step of calibrating the non-linear network model comprises adjusting the calibration based on information provided by an advisory model that represents another model of the non-linear empirical process that is different from the initial model, the non-linear network model, and the constrained model.
9. (Original) The method of Claim 8, wherein the advisory model is a first principles model of the non-linear empirical process.

10. (Previously presented) The method of Claim 1, wherein the non-linear empirical process is part of a greater process, and the method further includes the step of deploying the constrained model in a controller that controls the greater process.
11. (Currently Amended) A computer apparatus for building a model for modeling a non-linear empirical process, comprising:
 - a model creator for creating an initial model generally corresponding to the non-linear empirical process to be modeled, the initial model having a base non-linear function, an initial input and an initial output, the global behavior being at least in regions of sparse initial input;
 - a model constructor coupled to the model creator for constructing a non-linear network model based on the initial model, the non-linear network model having multiple inputs based on the initial input and a global behavior for the non-linear network model as a whole that conforms generally to the initial output; and
 - a calibrator coupled to the model constructor for calibrating the non-linear network model based on empirical inputs by using a bound on a derivative of the base non-linear function to constrain parameters of the model to produce a constrained model with global behavior of the non-linear network model, the constrained model providing precision control of the non-linear empirical process .
12. (Original) The computer apparatus of Claim 11, wherein the model creator specifies a general shape of a gain trajectory for the non-linear empirical process.
13. (Original) The computer apparatus of Claim 11, wherein the model creator specifies a non-linear transfer function suitable for use in approximating the non-linear empirical process.
14. (Original) The computer apparatus of Claim 13, wherein the non-linear network includes interconnected transformation elements and the model constructor incorporates the non-linear transfer function into at least one transformation element.

15. (Previously presented) The computer apparatus of Claim 14, wherein the calibrator sets constraints by taking a bounded derivative of the non-linear transfer function.
16. (Original) The computer apparatus of Claim 15, wherein the non-linear transfer function includes the log of a hyperbolic cosine function.
17. (Previously presented) The computer apparatus of Claim 11, wherein the model constructor constructs the non-linear network model based on a layered network architecture having a feedforward network of nodes with input/output relationships to each other, the feedforward network having transformation elements, each transformation element having a non-linear transfer function, a weighted input coefficient and a weighted output coefficient; and
the calibrator constrains the global behavior of the non-linear network model to a monotonic transformation based on the initial input by pairing the weighted input and output coefficients for each transformation element in a complementary manner to provide the monotonic transformation.
18. (Previously presented) The computer apparatus of Claim 11, further comprising an advisory model that represents another model of the non-linear empirical process that is different from the initial model, the non-linear network model, and the constrained model; and
wherein the calibrator adjusts the calibration based on information provided by the advisory model.
19. (Original) The computer apparatus of Claim 18, wherein the advisory model is a first principles model of the non-linear empirical process.
20. (Previously presented) The computer apparatus of Claim 11, wherein the non-linear empirical process is part of a greater process managed by a controller coupled to

controller optimizer, and the controller optimizer communicates the constrained model to the controller for deployment in the controller.

21. (Currently Amended) A computer program product that includes a computer usable medium having computer program instructions stored thereon for building a model for modeling a non-linear empirical process, such that the computer program instructions, when performed by a digital processor, cause the digital processor to:
 - create an initial model generally corresponding to the non-linear empirical process to be modeled, the initial model having a base non-linear function, an initial input and an initial output;
 - construct a non-linear network model based on the initial model, the non-linear network model having multiple inputs based on the initial input and a global behavior for the non-linear network model as a whole that conforms generally to the initial output, the global behavior being at least in regions of sparse initial input; and
 - calibrate the non-linear network model based on empirical inputs by using a bound on a derivative of the base non-linear function to constrain parameters of the model to produce a constrained model with global behavior the constrained model providing precision control of the non-linear empirical process.
22. (Previously presented) A computer-implemented method for building a model for modeling a polymer process, said method comprising the steps of:
 - specifying a base non-linear function for an initial model generally corresponding to the polymer process to be modeled, the initial model including an initial input and an initial output and the base non-linear function including a log of a hyperbolic cosine function;
 - constructing a non-linear network model based on the initial model and including the base non-linear function, the non-linear network model having multiple inputs based on the initial input and a global behavior for the non-linear network model as a whole that conforms generally to the initial output; and

calibrating the non-linear network model based on empirical inputs by using a bound on a derivative of the base non-linear function to constrain parameters of the model in order to produce a constrained model with global behavior, the constrained model providing optimized approximations to a process controller for controlling the polymer process.

23. (Previously presented) A computer apparatus for building a model for modeling a polymer process; comprising:

a model creator for specifying a base non-linear function for an initial model generally corresponding to the polymer process to be modeled, the initial model including an initial input and an initial output and the base non-linear function including a log of a hyperbolic cosine function;

a model constructor coupled to the model creator for constructing a non-linear network model based on the initial model and including the base non-linear function, the non-linear network model having multiple inputs based on the initial input and a global behavior for the non-linear network model as a whole that conforms generally to the initial output; and

a calibrator coupled to the model constructor for calibrating the non-linear network model based on empirical inputs by using a bound on a derivative of the base non-linear function to constrain parameters of the model in order to produce a constrained model with global behavior, the constrained model providing optimized approximations to a process controller for controlling the polymer process.

24. (Previously presented) A computer program product that includes a computer usable medium having computer program instructions stored thereon for building a model for modeling a polymer process, such that the computer program instructions, when performed by a digital processor, cause the digital processor to:

specify a base non-linear function for an initial model generally corresponding to the polymer process to be modeled, the initial model including an initial input and an

initial output and the base non-linear function including a log of a hyperbolic cosine function;

construct a non-linear network model based on the initial model and including the base non-linear function, the non-linear network model having multiple inputs based on the initial input and a global behavior for the non-linear network model as a whole that conforms generally to the initial output; and

calibrate the non-linear network model based on empirical inputs by using a bounded derivative of the base non-linear function to constrain the parameters of the model in order to produce a constrained model with global behavior, the constrained model providing optimized approximations to a process controller for controlling the polymer process.